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**AQUATIC INVERTEBRATES AND HABITAT AT A FIXED
STATION ON THE MISSOURI RIVER,
BROADWATER COUNTY, MONTANA**

July 11, 2001

**A report to
the Montana Department of Environmental Quality
Helena, Montana**

**by
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INTRODUCTION

This report is one of 38 brief interpretive summaries of data assembled as part of a statewide, multi-year study conducted by the Montana Department of Environmental Quality (MT DEQ). Each report discusses information generated from a single benthic invertebrate sample collection and habitat evaluation at a fixed station established on a gauged river or high-order tributary. The present treatise focuses on the aquatic community sampled on the Missouri River near Toston, Montana on July 11, 2001. The sample site was located by GPS reading at 46° 08' 35" N, 111° 24' 46" W, lying within the Montana Valley and Foothill Prairie Ecoregion (Woods et al. 1998). The sample was collected by personnel of MT DEQ. Sampling effort consisted of a composite of two Hess samples. Habitat parameters were evaluated using the MT DEQ Macroinvertebrate Habitat Assessment Field Form for streams with riffle/run prevalence. Invertebrate samples were processed and animals identified by Rhithron Associates, Inc. Analysis of invertebrate assemblages was accomplished by applying the revised method (Bollman 1998) for streams of Western Montana's ecoregions. The method uses a multimetric battery to evaluate disturbance to biotic integrity.

The revised bioassessment metric battery and its scoring criteria have not been evaluated for application to higher-order streams and rivers; to date, no bioassessment method has been contrived for these waterways in Montana. Thus, the method used here is likely to have limitations in its applicability to the sites in this study. For example, 24 of the riverine or high-order waterways sampled for the fixed station study were located within Western Montana ecoregions and were sampled between July 23 and August 25, 2001. Mean water temperature for these sites at the time of sampling was 19.8°C (median = 19.4°). Temperatures ranged from 15.5°C (Kootenai River near Libby) to 25.3°C (Jefferson River near Three Forks). Ninety-eight sites from Western Montana were used to assemble the revised metric battery and to test it for sensitivity in detecting impairment, to establish scoring criteria, and to improve robustness of bioassessment. These 98 sites were mainly second and third order streams; the sampling season roughly corresponded to that of the fixed-station study. Mean water temperature for these sites at the time of sampling was 15°C (median = 14°C). Natural variations in benthic community composition and structure along longitudinal and thermal gradients are well known phenomena. Thus, scores and classifications were established for much smaller systems with significantly lower water temperatures; impairment classifications and use support designations in this study must be interpreted with care. Results from the application of other metric batteries may be found in the Appendix.

RESULTS AND DISCUSSION

Table 1 itemizes the nine evaluated habitat parameters and shows the assigned scores for each, as well as the integrated score and condition category.

Overall habitat conditions scored optimally at this site. All instream habitat parameters were perceived to be ideal. Streambank vegetation on the right bank were disrupted to some extent, and the riparian zone width on both sides of the channel was judged sub-optimal.

Table 1. Stream and riparian habitat assessment for a fixed station on the Missouri River. July 2001.

Max. possible score	Parameter	Missouri River near Toston
10	Riffle development	10
10	Benthic substrate	9
20	Embeddedness	16
20	Channel alteration	19
20	Sediment deposition	18
20	Channel flow status	16
20	Bank stability: left / right	10 / 10
20	Bank vegetation: left / right	9 / 7
20	Vegetated zone: left / right	7 / 6
160	Total	137
	Percent of maximum CONDITION*	86 OPTIMAL

*Condition categories: Optimal > 80% of maximum score; Sub-optimal 75 - 56%; Marginal 49 - 29%; Poor <23%. Adapted from Plafkin et al. 1998.

Table 2. Metric values, scores, and bioassessment for a fixed station on the Missouri River . The revised bioassessment metric battery (Bollman 1998) was used for the evaluation. July 2001.

	Missouri River near Toston	
METRICS	METRIC VALUES	METRIC SCORES
Ephemeroptera richness	3	1
Plecoptera richness	0	0
Trichoptera richness	6	3
Number of sensitive taxa	0	0
Percent filterers	19.1	1
Percent tolerant taxa	68.2	0
	TOTAL SCORE (max.=18)	5
	PERCENT OF MAX.	28
	Impairment classification	MODERATE
	USE SUPPORT	PARTIAL

Bioassessment results are given in Table 2. When this bioassessment method is applied to these data, scores indicate that this site on the Missouri River is moderately impaired and only partially supports designated uses.

The elevated biotic index value (4.97) and low numbers of mayfly taxa suggest that water quality was impaired by warm temperature, excessive nutrients, or both. The measured water temperature at the time of sampling was 24.4°C, which was higher than the mean temperature for riverine sites in Western Montana visited for the fixed stations

study. However, the measured temperature as well as the taxonomic composition and tolerance characteristics of the benthic assemblage may be entirely appropriate for a large river. Taxa characteristic of riverine conditions, such as the caddisfly *Ceraclea* sp. and the mayfly *Choroterpes* sp. were present. The proportion of filter-feeders (19%) seems appropriate for a high-order river; all other expected functional components of a healthy assemblage were also present in the sample. The proportion of scrapers seemed low, however. The abundance of the caddisfly *Hydroptila* sp. indicated an ample presence of filamentous algae or other aquatic plants or mosses. Twenty-nine percent of the animals in the sample were in taxa that prefer fine sediments, including the mayfly *Tricorythodes minutus* and naidd and tubificid worms.

The presence of the hemoglobin-bearing midge taxa *Cryptochironomus* sp. and *Polypedilum* sp. suggest that anoxic sediments are present at the site. The warmth of the water in combination with the possibility that nutrients were relatively high could account for this condition. High nutrient concentrations would also help explain the large amounts of “moss” encountered by the sampling crew, as reported in field notes.

CONCLUSIONS

- Warm water temperature and possibly moderately high nutrients may account for the tolerance characteristics, taxonomic composition, and functional structure of the benthic assemblage at this site on the Missouri River. However, all of these attributes may be appropriate for a large river.
- The bioassessment method may have assigned an inappropriate impairment classification to the site. Impairment appears to be slight, given the tolerance characteristics and functional composition of the benthic assemblage.

LITERATURE CITED

Bollman, W. 1998. Improving Stream Bioassessment Methods for the Montana Valleys and Foothill Prairies Ecoregion. Master's (M.S.) Thesis. University of Montana. Missoula, Montana.

Bukantis, R. 1998. Rapid bioassessment macroinvertebrate protocols: Sampling and sample analysis SOP's. Working draft, April 22, 1997. Montana Department of Environmental Quality. Planning Prevention and Assistance Division. Helena, Montana.

Woods, A.J., Omernik, J. M. Nesser, J.A., Shelden, J., and Azevedo, S. H. 1999. Ecoregions of Montana. (Color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia. US Geological Survey.

APPENDIX

Taxonomic data and summaries

Missouri River

July 2001

Aquatic Invertebrate Taxonomic Data

Site Name: Missouri River near Toston

Date: 7/11/01

Site ID: M09MISSR01

Approx. percent of sample used: 7.5

Taxon	Quantity	Percent	HBI	FFG
<i>Dugesia</i> sp.	19	5.86	4	PR
Nematoda	1	0.31	11	PA
<i>Nais bretscheri</i>	1	0.31	8	CG
<i>Nais behningi</i>	6	1.85	8	CG
<i>Limnodrilus hoffmeisteri</i>	2	0.62	10	CG
lumina. Tubificid with cap. setae	5	1.54	10	CG
<i>Sphaerium</i> sp.	3	0.93	8	CF
Physidae	3	0.93	8	SC
<i>Acari</i>	2	0.62	5	PA
Total Misc. Taxa	42	12.96		
<i>Baetis tricaudatus</i>	39	12.04	4	CG
<i>Choroterpes</i> sp.	7	2.16	2	CG
<i>Tricorythodes minutus</i>	78	24.07	4	CG
Total Ephemeroptera	124	38.27		
<i>Brachycentrus occidentalis</i>	6	1.85	2	CF
<i>Cheumatopsyche</i> sp.	32	9.88	5	CF
<i>Hydropsyche</i> sp.	14	4.32	5	CF
<i>Hydroptila</i> sp.	48	14.81	6	PII
<i>Ceraclea</i> sp.	1	0.31	3	CG
<i>Oecetis</i> sp.	3	0.93	8	PR
Total Trichoptera	104	32.10		
<i>Microcylloepus</i> sp.	10	3.09	5	SC
Total Coleoptera	10	3.09		
<i>Simulium</i> sp.	7	2.16	5	CF
Total Diptera	7	2.16		
<i>Cricotopus Trifascia</i> Gr.	3	0.93	7	CG
<i>Cryptochironomus</i> sp.	1	0.31	8	PR
<i>Nanocladius</i> sp.	3	0.93	3	CG
<i>Polypedilum</i> sp.	28	8.64	6	SI1
<i>Thienemannimyia</i> Gr.	1	0.31	5	PR
<i>Tvetenia</i> sp.	1	0.31	5	CG
Total Chironomidae	37	11.42		
Grand Total	324	100.00		

Aquatic Invertebrate Summary

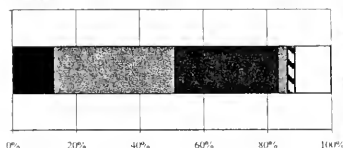
Site Name: Missouri River near Toston

Date: 7/11/01

SAMPLE TOTAL	324
EPT abundance	228
TAXA RICHNESS	26
Number EPT taxa	9
Percent EPT	70.37

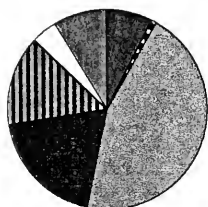
TAXONOMIC COMPOSITION

GROUP	PERCENT	#TAXA	ABUNDANCE
Misc. Taxa	12.96	9	42
Odonata	0.00	0	0
Ephemeroptera	38.27	3	124
Plecoptera	0.00	0	0
Hemiptera	0.00	0	0
Megaloptera	0.00	0	0
Trichoptera	32.10	6	104
Lepidoptera	0.00	0	0
Coleoptera	3.09	1	10
Diptera	2.16	1	7
Chironomidae	11.42	6	37



FUNCTIONAL COMPOSITION

GROUP	PERCENT	#TAXA	ABUNDANCE
Predator	7.41	4	24
Parasite	0.93	2	3
Gatherer	45.06	11	146
Filterer	19.14	5	62
Herbivore	0.00	0	0
Piercer	14.81	1	48
Scraper	4.01	2	13
Shredder	8.64	1	28
Xylophage	0.00	0	0
Omnivore	0.00	0	0
Unknown	0.00	0	0



- Misc. Taxa
- Odonata
- Ephemeroptera
- Plecoptera
- Hemiptera
- Megaloptera
- Trichoptera
- Lepidoptera
- Coleoptera
- Diptera
- Chironomidae

- Predator
- Parasite
- Gatherer
- Filterer
- Herbivore
- Piercer
- Scraper
- Shredder
- Xylophage
- Omnivore
- Unknown

COMMUNITY TOLERANCES

Sediment tolerant taxa	4
Percent sediment tolerant	27.16
Sediment sensitive taxa	0
Percent sediment sensitive	0.00
Metals tolerance index (McGuire)	4.24
Cold stenotherm taxa	0
Percent cold stenotherms	0.00

Site ID: M09MISSR01

TAXON	ABUNDANCE	PERCENT
<i>Tricorythodes minutus</i>	78	24.07
<i>Hydrotilla</i> sp	48	14.81
<i>Baetis tricaudatus</i>	39	12.04
<i>Cheumatopsyche</i> sp	32	9.88
<i>Polypedilum</i> sp	28	8.64
SUBTOTAL 5 DOMINANTS	225	69.44
<i>Eugesia</i> sp	19	5.86
<i>Hydropsyche</i> sp	14	4.32
<i>Microveloceps</i> sp	10	3.09
<i>Choroterpes</i> sp	7	2.16
<i>Simulium</i> sp	7	2.16
TOTAL DOMINANTS	282	87.04

SAPROBITY

Hilsenhoff Biotic Index	4.97
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DIVERSITY

Shannon H (log _e)	2.49
Shannon H (log ₂)	3.60

Simpson D

0.12

VOLITINISM

TYPE	ABUNDANCE	PERCENT
Multivoltine	127	39.04
Univoltine	182	56.02
Semivoltine	16	4.94

TAXA CHARACTERS

Tolerant	#TAXA	ABUNDANCE	PERCENT
Tolerant	9	221	68.21
Intolerant	0	0	0.00
Clinger	8	148	45.68

BIOASSESSMENT INDICES

B-IBI (Karr et al.)

METRIC	VALUE	SCORE
Taxa richness	26	3
E richness	3	1
P richness	0	1
T richness	6	3
Long-lived	2	1
Sensitive richness	0	1
%tolerant	68.21	1
%predators	7.41	1
Clinger richness	8	1
%dominance (3)	50.93	3
TOTAL SCORE		16

32 %

MONTANA DEQ METRICS (Bukantis 1998)

METRIC	VALUE	Plains Ecoregions	Valleys and Foothills	Mountain Ecoregions
Taxa richness	26	3	2	2
EPT richness	9	3	0	0
Biotic Index	4.97	3	2	1
%Dominant taxon	24.07	3	3	3
%Collectors	64.20	2	2	2
%EPT	70.37	3	3	3
Shannon Diversity	3.60	3		
%Scrapers + Shredd	12.65	1	1	0
Predator taxa	4	2		
%Multivoltine	39.04	3		
%H of T	44		3	
TOTAL SCORES		26	16	11
PERCENT OF MAXIMUM		86.67	66.67	52.38
IMPAIRMENT CLASS		NON	SLIGHT	MODERATE

Montana DEQ metric batteries

